

TRENDS AND STATUS OF WETLAND AND AQUATIC HABITATS IN THE GALVESTON BAY SYSTEM, TEXAS

EXECUTIVE SUMMARY

by
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INTRODUCTION

Wetland and aquatic habitats are essential biological components of the Galveston Bay Estuarine System. Understanding the spatial and temporal distribution of these habitats is critical if they are to be effectively protected and managed. This report presents results of an investigation sponsored by the Galveston Bay National Estuary Program (GBNEP) to determine the trends and status of wetlands and aquatic habitats in the Galveston Bay system through aerial photographic analysis supported by field surveys.

METHODS

Status and trends of wetlands in the Galveston Bay system were determined by analyzing the distribution of wetlands mapped on aerial photographs taken in the 1950's, 1979, and 1989. Wetlands for all maps were delineated on photographs through stereoscopic interpretation using procedures developed for the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory program. Field reconnaissance was an integral part of the interpretation process. Wetlands were mapped in accordance with the classification by Cowardin and others (1979), in which wetlands were classified by system (marine, estuarine, riverine, palustrine, lacustrine), subsystem (reflective of hydrologic conditions), and class (descriptive of vegetation and substrate). Maps for 1979 and 1989 were additionally classified by subclass (subdivisions of vegetated classes only), water-regime, and special modifiers. Upland habitats were delineated on 1979 and 1989 maps using a modified Anderson and others (1976) land-use classification system.

More than 180 field sites were examined as part of the effort to characterize wetland plant communities and define wetland map units in the Galveston Bay system. Topographic surveys were conducted along several transects. County soil surveys were used to define and characterize soils at the various field check sites.

CURRENT STATUS: 1989

Wetlands and aquatic habitats are dominated by an estuarine system that encompasses approximately 507,500 acres (table I) in the 30 7.5-minute quadrangles that make up the Galveston Bay study area (fig. I). Major estuarine and palustrine habitats include salt, brackish, and fresh marshes, forested and scrub-shrub wetlands, subtidal aquatic beds, intertidal flats, and estuarine open water (table II). Vegetated wetlands (marshes, scrub-shrub, and forested

Table I. Areal extent of wetland systems and uplands.

| Wetland System | Acres | Percent of Study Area Coverage |
|----------------|----------------|--------------------------------|
| Estuarine | 507,500 | 47.5 |
| Palustrine | 34,100 | 3.2 |
| Lacustrine | 21,600 | 2.0 |
| Riverine | 3,000 | 0.3 |
| Marine | †2300 | †0.2 |
| Uplands | 498,900 | 46.7 |

†Excludes marine open water.

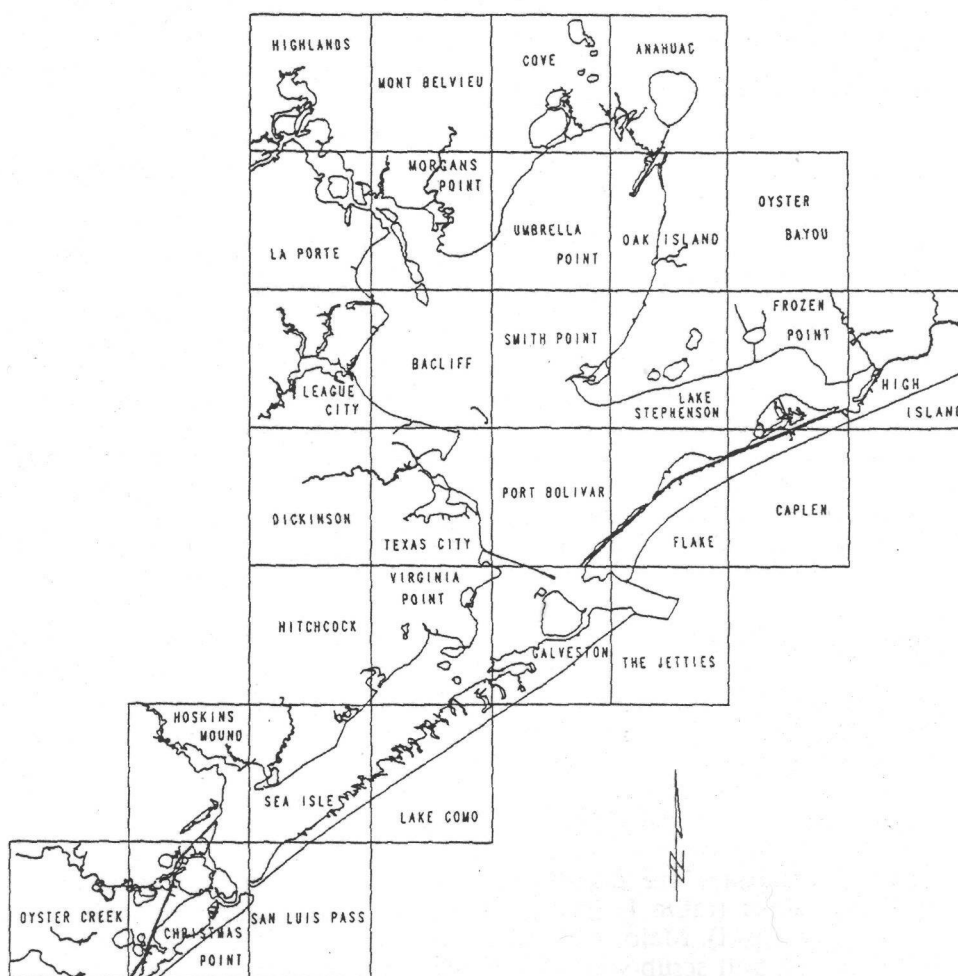


Figure I. Study area defined by 30 USGS 7.5-minute quads.

Table II. Current status (1989) of major estuarine and palustrine habitats.

ESTUARINE SYSTEM

Estuarine Intertidal Emergent Wetlands (Salt and Brackish Marshes)

Most extensive wetland habitat in the study area
108,200 acres of salt and brackish marshes
Composes 75% of vegetated wetlands* and 83% of the marsh habitats (emergent wetlands)

Estuarine Intertidal Unconsolidated Shores

Intertidal flats and beaches
17,800 acres in Galveston Bay system
Extremely low tides when photographs were taken caused many areas that would normally have been submerged to be mapped as flats instead of open water

Estuarine Intertidal Scrub/Shrub Wetlands

550 acres total with most quads having less than 50 acres
Morgans Point and Virginia Point each have about 100 acres

Estuarine Aquatic Beds

700 acres of submerged vascular vegetation in Galveston Bay system proper
(excluding smaller inland water bodies and misinterpreted areas)
Largest area (386 acres) in Christmas Bay; remainder along margins of upper Trinity Bay

Estuarine Subtidal Unconsolidated Bottom

378,200 acres of open water (65% of study area)
Includes Galveston, Trinity, East, West, Christmas, and Chocolate Bays, etc.

PALUSTRINE SYSTEM

Palustrine Emergent Wetlands (Fresh, or Interior, Marshes)

22,200 acres (16% of vegetated wetlands and 17% of marsh habitat)
Most extensive distribution is along the Trinity River alluvial valley
and inland of Christmas, West, and East Bays

Palustrine Scrub/Shrub Wetlands

2,000 acres (1.4% of vegetated wetlands)
Largest acreages (> 300 acres each) occur in Dickinson and Highlands quads
Most quads have less than 100 acres

Palustrine Forested Wetlands

5,648 acres (4% of vegetated wetlands)
Most abundant in Trinity River valley; other notable quads include Oyster Creek, Highlands, and Hitchcock

*Vegetated wetlands as used in this table do not include aquatic beds

wetlands) have a total area of about 138,600 acres, or 13 percent of all habitats (fig. II). Marshes, or estuarine and palustrine emergent wetlands, cover approximately 130,400 acres, representing about 94 percent of vegetated wetlands. Estuarine emergent wetlands (salt and brackish marshes) are the most extensive wetlands in the study area (fig. III). The most extensive upland habitat is rangeland (fig. IV).

TRENDS: 1950'S TO 1979 TO 1989

There were gains and losses in wetlands from the 1950's to 1989, but the net trend was one of wetland loss. This downward trend is illustrated by acreages of 171,000 in the 1950's, 146,000 in 1979, and 138,600 in 1989 (table III and fig. V). The rate of loss, however, decreased over time from about 1,000 acres per year between 1953 and 1979, to about 700 acres per year between 1979 and 1989. The rate of loss for the period 1979 to 1989 would be lower (<500 acres/yr) if inaccuracies in wetland interpretation on the 1979 photographs are taken into account. In general, scrub-shrub habitats decreased in area from the 1950's to 1979 and 1989 while forested wetlands increased (table III).

OVERALL TRENDS AND THEIR PROBABLE CAUSES: 1950-1989

In analyzing trends, emphasis was placed on wetland classes and not on water regimes and special modifiers. This approach was taken because habitats were mapped only down to class on 1950's photographs and because the 1979 photographs were taken during a period of high tides and the 1989 photographs during a period of low tides. It should also be noted that there are a number of possible photointerpretation shortcomings—not the least of which is the involvement of different photointerpreters at different times.

Emphasis is placed on net losses in wetlands. Losses in wetland vegetation resulted from conversion of the wetlands to (1) open water and flats, (2) uplands, and (3) other wetland classes. From the 1950's to 1989, there was a net loss in vegetated wetlands of 32,400 acres, which amounts to 19 percent of the vegetated wetland system that existed in the 1950's. The actual loss in wetlands is somewhat less, perhaps closer to 17 percent, because delineations of wetlands in some areas on the 1950's-vintage black-and-white aerial photographs included peripheral upland areas, which inflated the 1950's wetland acreages.

Estuarine and Palustrine Emergent Wetlands

The area of mapped emergent wetlands (marshes) decreased from about 165,500 acres in the 1950's to about 130,400 acres in 1989, producing a total net marsh loss of approximately 35,100 acres, or 21 percent of the 1950's resource. As in the case of vegetated wetlands, this amount of loss in emergent wetlands is thought to be on the high side; the actual loss is probably below 19 percent.

Net losses in vegetation occurred in 25 of the 30 quadrangles (quads) studied. The most substantial losses occurred in the southwest part of the study area and include Virginia Point, Hitchcock, Hoskins Mound, Texas City, and Sea Isle (fig. I). Approximately 55 percent of the total losses of emergent vegetation in the Galveston Bay System occurred in these areas. The most extensive net loss, exceeding 5,000 acres, occurred in the Virginia Point quad on the inland margin of West Bay.

The causes of wetland loss include both natural and artificial processes. Among them are humanly induced subsidence and relative sea-level rise, and draining and filling of wetlands for agricultural, transportation, industrial, residential, and commercial purposes (table IV). Major losses in estuarine emergent wetlands (salt and brackish marshes) occurred as they were converted to open water and barren flats. Major losses in palustrine emergent wetlands (interior, or fresh marshes) resulted from their conversion to uplands.

Current Status (1989) of Galveston Bay Habitats
Total acreage: 1,066,000

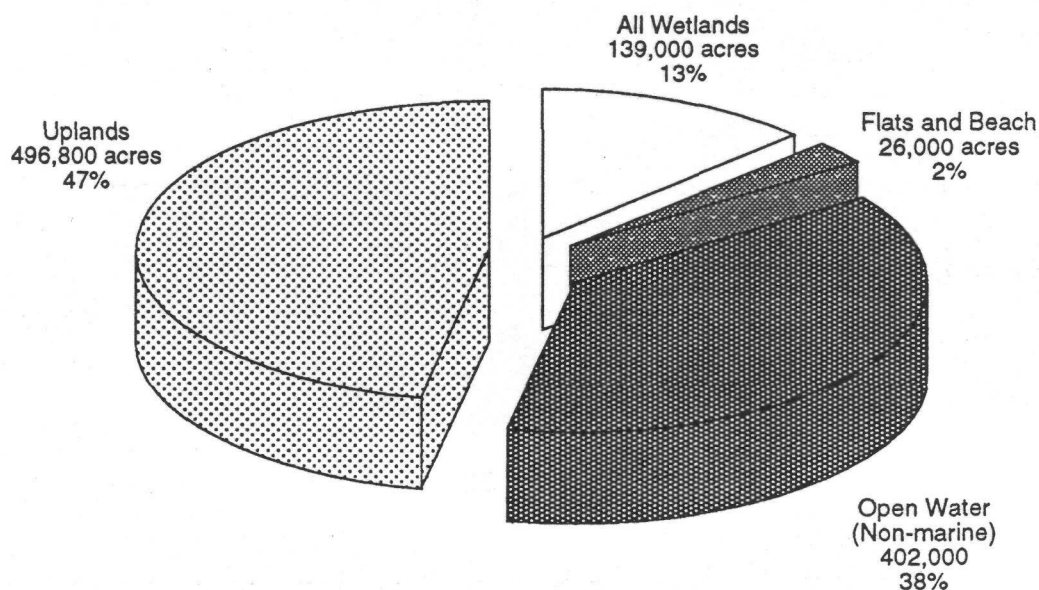


Figure II. Current status of Galveston Bay habitats.

Extent of Vegetated Wetlands in 1989

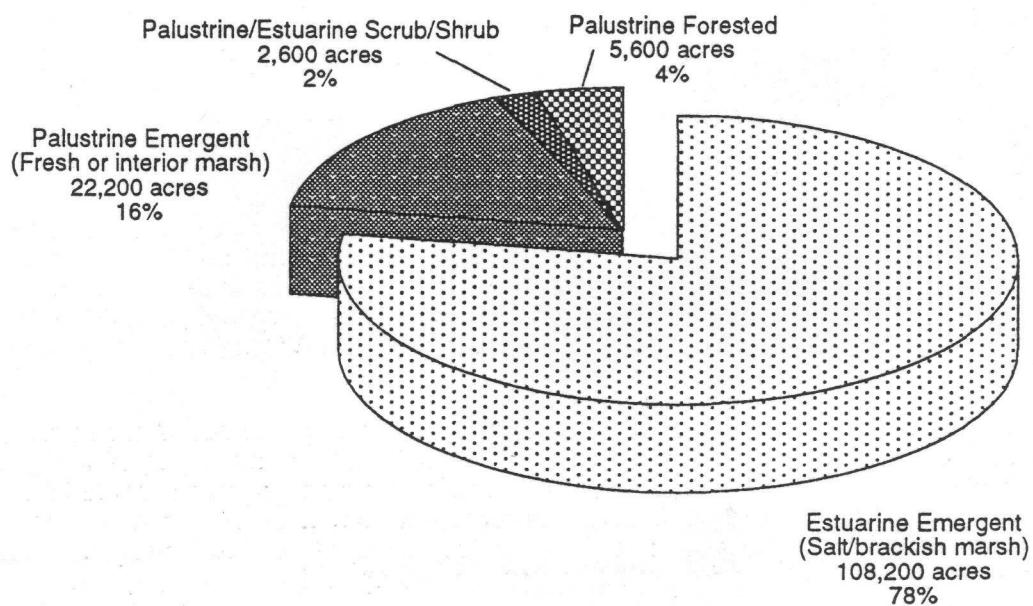


Figure III. Areal extent of vegetated wetlands in 1989.

UPLAND HABITATS IN 1989

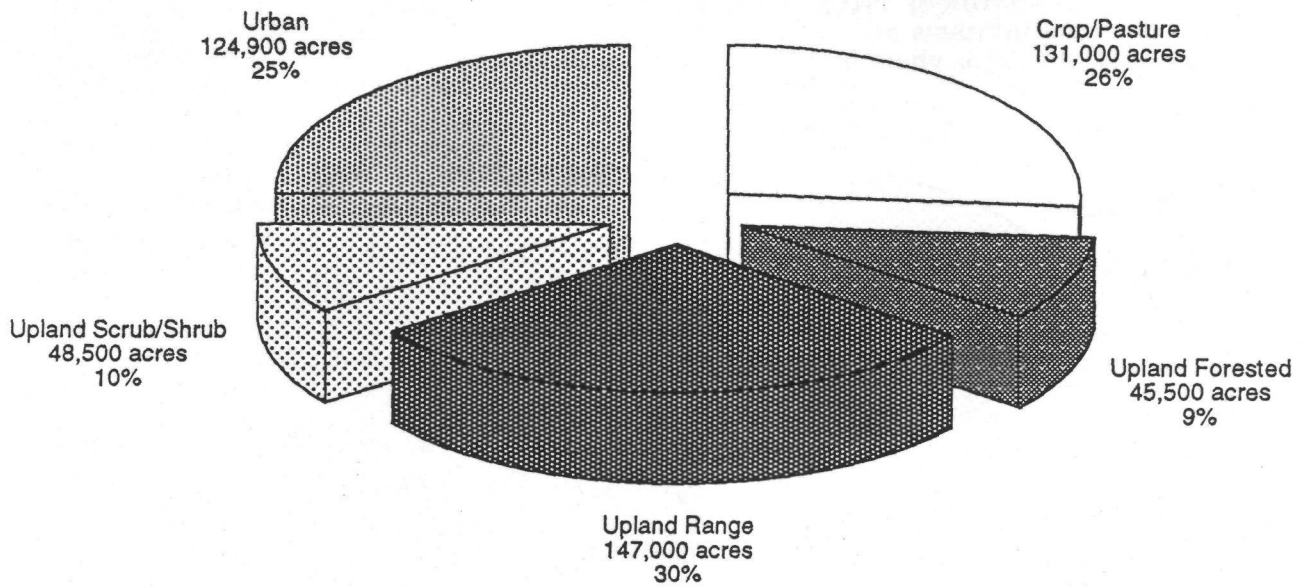


Figure IV. Areal extent of upland habitats in 1989.

Wetland Habitat Trends for Galveston Bay

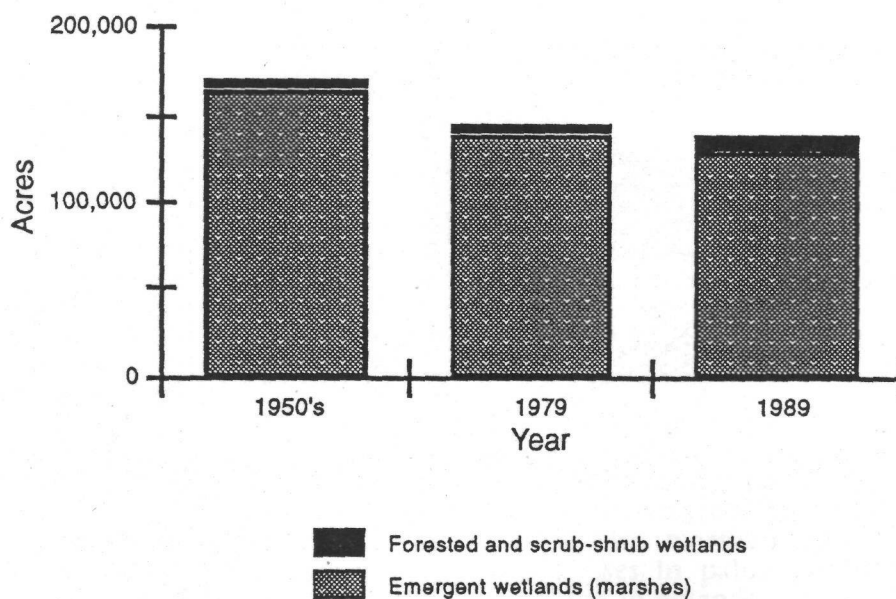


Figure V. Trends in marshes and forested and scrub-shrub wetlands in the Galveston Bay system.

Table III. Areal extent of vegetated wetlands and aquatic beds in the 1950's, 1979, and 1989.

| Wetland Type | Area (acres) | | |
|--|----------------|----------------|----------------|
| | 1950's | 1979 | 1989 |
| Estuarine and Palustrine Emergents (marshes) | 165,500 | 138,130 | 130,370 |
| Scrub/Shrub | 3,430 | 2,300 | 2,570 |
| Forested | 2,040 | 5,580 | 5,650 |
| Total | 170,970 | 146,010 | 138,590 |
| Estuarine Subtidal Aquatic Beds | 2,500 | N/A | 700 |

Table IV. Major causes of wetland losses from the 1950's to 1989.

| Cause of Emergent Wetland (Marsh) Loss | Acres Lost |
|---|------------|
| Conversion to open water and flat principally due to subsidence and relative sea-level rise | 26,450 |
| Conversion to Uplands | |
| Upland Range | 25,000 |
| Upland Urban | *5,700 |
| Upland Agriculture | 3,600 |
| Upland Spoil | 1,500 |
| Total Conversion to Uplands | **35,800 |

*Includes 800 Acres of Upland Oil and Gas

**Changes (apparent losses) are in part due to photointerpretation

Although the net loss in emergent wetlands (marshes) from the 1950's to 1989 encompassed about 35,000 acres, the gross loss, exclusive of offsetting gains in other areas, was considerably larger—approximately 88,500 acres. Conversion of emergent wetlands to open water and flats exceeded 26,400 acres, accounting for about 30 percent of the total gross loss. There is evidence that humanly induced subsidence and associated relative sea-level rise was the major factor contributing to the conversion of marshes to open water and barren flats (table IV). Subsidence along active surface faults contributed to marsh loss in some areas.

Major losses in interior, or fresh, marshes occurred as large areas of palustrine emergent wetlands were transformed to uplands. The magnitude of this change is approximately 35,600 acres from the 1950's to 1989, and accounts for about 40 percent of the total gross loss in palustrine and estuarine emergent wetlands. The change from emergent wetlands in the 1950's to upland rangeland in 1989 encompassed 25,400 acres. Conversion of wetlands to urban upland areas amounted to 5,700 acres, and to cropland and pastureland, 3,600 acres (table IV). It appears that some changes are related to natural conditions, such as annual (and seasonal) changes in moisture levels, which affected photointerpretation, but a substantial amount of the change appears to be due to draining of wetlands. This has been a common practice, especially from the 1950's to 1970's. Approximately 33 percent of the gross loss in emergent wetlands is attributed to the conversion of marshes to upland rangeland and cropland.

Losses in emergent wetlands in some areas were partly offset by gains in emergent wetlands in other areas. Conversion of uplands to emergent wetlands accounted for an increase of about 21,000 acres. Regionally, these changes were most pronounced inland from East, West, and Christmas Bays. The conversion of uplands to wetlands generally took place in transitional areas peripheral to existing wetlands, and appears to be related to subsidence and associated relative sea-level rise in some areas. Additional increases in emergent wetlands resulted from the spread of emergent vegetation across intertidal flats. However, the replacement of vegetated areas by flats was a much more significant process.

Although vegetated wetland expansion may have partially offset wetland losses in terms of acreage, this offset does not necessarily apply in terms of overall functional value. There is evidence that newly created wetlands are not functionally equivalent to older, long-established wetlands.

Scrub-Shrub and Forested Wetlands

The general trend in scrub-shrub wetlands for the 1950's to 1989 period was one of net loss. However, this trend was countered by forested wetlands, which had a significant net gain. Scrub-shrub wetlands decreased by approximately 850 acres, representing a loss of about 25 percent of the 1950's resource. Forested wetlands, on the other hand, increased in area by approximately 3,600 acres, an increase of about 1.8 times the 1950's area. Much of this gain in forested wetlands was due to (1) taller growth of shrubs and trees in areas previously mapped as scrub-shrub wetlands and (2) inconsistent delineation of forested wetlands on the different sets of photographs. Locally, losses in forested wetlands were due to alterations in hydrology.

Estuarine Aquatic Beds

Submerged vascular vegetation decreased from about 2,500 acres in the 1950's to approximately 700 acres in 1989, reflecting a decline in submerged vegetation of 1,800 acres, or more than 70 percent of the 1950's habitat. There is evidence from another study that submerged vegetation in the mid-1950's may have been as extensive as 5,000 acres, reflecting a decline of 86 percent of this resource by 1989. Loss of submerged vegetation has been attributed to subsidence and Hurricane Carla in parts of Galveston Bay, and to human activities including development, wastewater discharges, chemical spills, boat traffic, and dredging activities in West Bay (Pulich and White, 1991).